with a set of species in which the members are freely interbreeding but which are apparently isolated from all other groups.

In the case of the Macrantherae, however, which contains a large number of species, it is equally clear that several otherwise rather distinct groups of species are placed together on the basis of anther morphology. It is probable that some of these cannot interbreed. One group of the Macrantherae, the Transversae, is well defined by a number of characters. It is cut off rather sharply from the "Macrantherae-Normales" group, which contains a set of species, many of which are known to hybridize between themselves. It has been suggested, on rather slender grounds, that these two groups can interbreed. Any data which would more rigorously support this view are of interest because they would indicate affinity between them, and so help to reduce to a more sound basis the grouping of the units at present lumped together somewhat "artificially" in the Macrantherae.

The record, then, of the successful production by manipulated pollination of an F1 hybrid between *E. robusta* Sm.—which belongs to the series Transversae—and *E. cinerea* F. Muell.—belonging to the section Macrantherae (Normales)—is of considerable interest since it establishes experimentally that at least these two members of the group can successfully interbreed to the extent of producing viable F1 progeny.

TABLE 1.

Juvenile Leaf Characters.

E. robusta.	*E. cinerea.*	F1, *E. cinerea* × *E. robusta.*
1. Stems square, somewhat winged.	Terete.	Square, somewhat winged.
2. Plants green.	Glaucous.	Somewhat glaucous.
3. Leaves petiolate.	Sessile.	Very shortly petiolate.
4. Leaves alternate.	Opposite.	Opposite.
5. Leaves lanceolate.	Orbicular.	Intermediate (ovate-lanceolate).

Characters 2, 3 and 5 are intermediate; 1 is like *E. robusta* and 4 is like *E. cinerea*.

In spring, 1952, manipulated pollinations were made on bagged flowers of *E. cinerea*, emasculated about a week before. The species used as the male parent in each case were substantially distinct from *E. cinerea*, the combinations being chosen because they represented supposedly wide crosses. Controls, not pollinated, and selfings were made at the same time. The controls did not set seed, whereas the selfings set normally and produced good seed. Of the cross pollinations, all failed except one, which was notably successful, namely, *E. robusta*. Fruit developed normally in the four bags used, producing a total of some thirty fruit. They were harvested in October, 1953, and about seventy plants were raised. These by March, 1954, reached the seventh pair of leaves and were vigorous. The progeny was strikingly uniform and had morphological characters in the juvenile state, some of which were intermediate between those of the two parents, which in themselves are quite distinct, and some identical with one or other parent. This is summarized in Table 1.

This hybrid combination is of considerable interest for two reasons. Firstly, no other case is so far recorded of the experimental production of a hybrid between species belonging one each to the systematic groups Macrantherae-Normales and the Transversae.

Secondly, a similar combination has not yet been suggested, even by the less critical method of progeny testing, from naturally occurring supposed hybrids, although a few such mixtures are hinted at from morphological evidence collected in the field. At the same time it is a combination which cannot occur naturally, as the two species are separated by a considerable geographical distance and occupy ecological sites which

are widely divergent. *E. cinerea* is a species of the Southern Tablelands of New South Wales at elevations generally above 1,500 feet, and does not descend to the coastal plain, whereas *E. robusta* is a species of low-lying areas along the whole New South Wales coast which are frequently subject to tidally induced flooding and the soil of which is often somewhat saline.

While one may not proceed from this one example to the generalization that all species of the Transversae and the Macrantherae-Normales can successfully hybridize, the particular evidence makes the assumption that many of them may successfully interbreed now much more probable than previously. In view of this, there are important possibilities from the point of view of breeding programmes, aimed both at research and practical ends, which warrant further experiment.

Many of the Transversae, which contains about 20 species, are excellent trees (such as *E. saligna*, *E. resinifera*, *E. botryoides*, *E. propinqua* and *E. diversicolor*), both from the point of view of timber and in cultural characters required in species for rural planting. Most, however, are not very frost-resistant nor can they be planted as a rule beyond the well-watered areas of the country. The prospect that characters from this group may be brought together in hybrid combination with species within Macrantherae-Normales (containing the series Microcarpae, Globulares, Semiunicolores, Viminales, Argophyllae and Paniculatae), which amount to about seventy, is of considerable interest. Many of these possess cold and drought resistant characters which are missing from the Transversae. The combination already produced is of this nature and, if ultimately it flowers and is found to be fertile, it may give segregates of considerable value in the F2 generation.

Following experience with other groups in the genus, it is likely by analogy that since one hybrid combination has been produced, many others can be obtained between pairs of species from the same groups, and some of these are likely to be economically valuable.

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A NOTE ON THE OCCURRENCE OF "ANOMALOUS" KRASNOZEM IN THE RICHMOND–TWEED REGION OF NEW SOUTH WALES.

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(*Communicated by Dr. W. R. Browne.*)

(Plate viii, and One Text-figure.)

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Synopsis.

The krasnozem soils lying to the west of the 55″ rainfall isohyet in the Region, previously described as "anomalous", are not developed on basalt but on a highly sesquioxidic clay material interstratified in basalt.

The interstratified material is described and some analytical data for this and associated materials presented. The origin of the material is uncertain but the occurrence of some of the contiguous red and "black" soils of the Region is thereby explained.

The red and "black" soils developing on Tertiary basalt in the Richmond-Tweed region of New South Wales have been described by Hallsworth (1951) and classified at the great soil group level. The pattern of distribution of these soils is such that the red soils or krasnozems cover large areas of the basalt plateau to the east of the 55″ rainfall isohyet while the "black" soils, chocolate and praire, are found on the more sharply dissected plateau remnants to the west. Hallsworth (1951, 1953) and Nicholls (1952) consider that the climatic factor is the chief determinant in the present distribution of the krasnozems, while Teakle (1952, 1953) holds the view that they are relict soils, some of which are derived from laterite.

The presence of small areas of krasnozems lying in lower rainfall areas to the west of the 55″ rainfall isohyet in this region, although observed by Hallsworth (1951), has not been explained adequately. Hallsworth regarded these soils as "anomalous" because they did not fit the climatic theory of distribution, and suggested that they were relics of a previous wetter climate.

Recent observations made near Kyogle and Casino indicate that the "anomalous" krasnozem soils are not derived from a normal basaltic parent material but from a relatively easily weathered stratum within the main basalt mass.

The interstratified material, of which three distinct types are recognizable, often forms extensive, roughly horizontal sheets from one to six feet thick, outcropping at much the same level over distances of a half-mile or more. Several bands of this material, separated by unweathered basalt, have been observed outcropping on steep scarps, indicating that the material is not uniquely associated with one flow or period of activity (Fig. 1).

The material may be described as a compacted, unctuous clay which adheres to the tongue on moistening and slakes in water with a faint crackling sound, but does not show expansion properties.* Both red and grey types are found interstratified in the basalt, but the former has the wider distribution. A further type has a strong vesicular structure.

The hardness of the red clay varies from slightly compacted to moderately indurated, the latter variant being less commonly encountered, while colour ranges from bright red to reddish brown. Typical examples are shown in Plate viii, figures 1 and 2, underlying unweathered or partly weathered basalt. The red clay, at its junction with the overlying basalt, generally shows an ashy grey layer from ½″ to 3″ in depth, which is of fine particle size and often unconsolidated. This layer changes abruptly into the

* The term *bentonite* has not been used because of this last-named property. *Bole*, as defined by Holmes (1920), closely resembles some of the material here described.